

DOCUMENT RESUME

ED 336 277

SE 052 288

TITLE Junior High Science Curriculum Support Document,
Grades 7 to 9.

INSTITUTION Northwest Territories Dept. of Education,
Yellowknife.

PUB DATE 91

NOTE 57p.

PUB TYPE Guides - Classroom Use - Teaching Guides (For
Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.

DESCRIPTORS Classroom Techniques; Course Evaluation; Foreign
Countries; *Junior High Schools; Laboratory Animals;
Metric System; Periodicals; Planning; Plants
(Botany); Problem Solving; Questioning Techniques;
*Resource Materials; Safety; Science Education;
Science Fairs; *Secondary School Science; *Student
Evaluation; *Teaching Methods

IDENTIFIERS Northwest Territories

ABSTRACT

This document provides information on and examples of various topics related to the successful translation of the curriculum guidelines from the Department of Education to the Jurisdiction and School levels in the Northwest Territories, Canada. Different student evaluation techniques are explored as well as the topic of unit evaluation. The additional information that is provided may assist the teacher in creating a language-rich, well-organized, interesting, relevant, and safe environment in the classroom. Sections include: (1) "Student Evaluation"; (2) "Unit Evaluation"; (3) "Classroom Organization and Management"; (4) "Safety in Science"; (5) "Science Fair Information"; (6) "Research and Reporting Skills"; (7) "Magazines/Clubs for Junior High Students and Teachers"; (8) "Effective Questioning Techniques"; (9) "Asking Good Questions"; (10) "Study Skills"; (11) "Looking at Problems and Questions from Different Perspectives"; (12) "Sustainable Development Information for Junior High Teachers"; (13) "Plant and Animal Care"; (14) "Use of Systeme Internationale or S.I. (metric system)"; (15) "Publishers/Distributors"; and (16) "Suppliers." (KR)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED336277



U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

• This document has been reproduced as
received from the person or organization
originating it.

□ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

D. Crane

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

JUNIOR HIGH SCIENCE

BEST COPY AVAILABLE

***JUNIOR HIGH SCIENCE
CURRICULUM SUPPORT
DOCUMENT***

School Curriculum Services
Department of Education
Northwest Territories
1991

FOREWORD

This **curriculum support document** has been produced to provide information and examples on various topics related to the successful translation of the curriculum guidelines from the Department of Education to the Jurisdiction and School levels.

Different student evaluation techniques are explored as well as the topic of unit evaluation.

The additional information which is provided will assist the teacher in creating a language rich, well organized, interesting, relevant and safe environment in the classroom.

For information regarding sample programs which address the curriculum guidelines and program development for both multigrade and single grade situations, as well as resource correlations, consult the "Guidelines For Program Development" section of the Junior High Science Curriculum Document.

ACKNOWLEDGMENTS

The N.W.T. Department of Education acknowledges the contribution of the many people who assisted so ably in the revision process and in the preparation and development of the Junior High Science Curriculum. This support document arises from a section on "Resources for Teacher Use" which was included in the field validation version of the junior high science curriculum guide.

Special recognition is given to those who assisted in the development of this publication through their participation on the Junior High Science Subject Advisory Committee.

Dora Grandjambe, Dene
Cultural Institute, Yellowknife
Clive Whitfield, Principal, Helen
Kalvak School, Holman
Steve Daniel, Teacher, Tusarvik
School, Repulse Bay
Brian Jaffray, Teacher Consultant,
Fort Simpson Area
Wendy Brewster, Teacher, Samuel
Hearne Secondary School, Inuvik
Jeanette Ireland, Teacher Consultant,
Baffin Divisional Board, Iqaluit
Roger Gillies, Teacher, William
McDonald Junior High School,
Yellowknife
Les Cameron, Teacher, St. Patrick High
School, Yellowknife
Vern Jones, Teacher, Diamond Jenness
High School, Hay River
Marlene Semsch, Principal, Kaw Tay
Whee School, Dettah

The Government of the Northwest Territories wishes to thank the provinces of Manitoba, Alberta and British Columbia for their ongoing assistance in the production of this guide.

In particular, the Department thanks Alberta Education for permission to adapt material on classroom management and organization, and looking at questions and problems from different perspectives, the nature of science, science and technology, and science, technology and society; British Columbia Education for materials on library research and reporting skills and self-assessment; and to Manitoba Education for materials related to evaluation: and to the Alberta Science Education Consultants for permission to adapt materials related to evaluation.

Florence Sliney, staff and students of Qarmartalik School (Resolute Bay) and Clive Whitfield, staff and students of Helen Kalvak School (Holman) are gratefully acknowledged for many of the photos contained in this document.

Don Kindt, Curriculum Coordinator for Sciences, was responsible for the development of this publication.

TABLE OF CONTENTS

Resources / Information For Teacher Use

Student Evaluation	1		
Basic Principles	1	Research and Reporting Skills	30
Subjective Evaluation	1		
Objective Evaluation	1	Magazines/Clubs for Junior High Students and Teachers	32
Evaluating Process Skills	3		
Process Skills and Their Attendant Behaviours	5	Effective Questioning Techniques	34
Checking the Growth of the Inquiry Process	6	Asking Good Questions	36
Evaluating an Investigation	6	Study Skills	38
Determining Attitudes	7		
Impressionistic Scoring	9	Looking at Problems and Questions From Different Perspectives	40
Projects	10		
Anecdotal Records	10	Sustainable Development Information for Junior High Teachers	42
Self Assessment	11		
Self-Rating Scale for Oral Presentations	11	Plant and Animal Care	44
Peer Evaluation	12		
Group Effectiveness		Use of Systeme Internationale or S.I. (metric system)	49
Appraisal Form	12		
Evaluating Group Work	13	Publishers/Distributors	50
Guidelines for Construction of Test Questions	14	Suppliers	51
Notes and Reports	15		
Lab Reports	15		
Format For Reports	16		
Learning Log Entries	17		
Reading & Note Taking	18		
Semantic Mapping	20		
Dialectical Notebooks	21		
Scripting	22		
Unit Evaluation	24		
Classroom Organization and Management	26		
Safety in Science	27		
Science Fair Information	28		
Philosophy	28		
Types of Projects	28		
Judging	29		

STUDENT EVALUATION

The evaluation report should indicate how well the relative knowledge, skills, attitudes and values have been learned.

Many formal and informal evaluation techniques have been developed over the past few years which are suited to this purpose.

BASIC PRINCIPLES

The following should be viewed as basic principles to assist jurisdictions in designing appropriate ways to evaluate student progress.

1. Evaluation is an integral part of the teaching process, not separate or adjunct to it.
2. Evaluation strategies should reflect and enhance all the objectives for learning.
3. Evaluation should be seen as a natural teaching activity and not as a burden.
4. The primary purpose of evaluation is to collect relevant data for making judgements and decisions.
5. Evaluation is a continuous and ongoing process.
6. Our view of learning will affect our concept of evaluation.
7. Student evaluation is a responsibility shared by the Department of Education, school jurisdictions, teachers and students.

8. The evaluation process must be fair and just, and perceived to be so by students.

9. A good evaluation program will incorporate an extensive variety of testing instruments which automatically utilizes the full range of subjective to objective scoring.

SUBJECTIVE EVALUATION

Subjective evaluation is based on or is dependent on the feelings of the mind of the individual doing the evaluation rather than being based on a set of predetermined criteria that is external to the feelings of the mind.

OBJECTIVE EVALUATION

Objective evaluation is based on a set of predetermined criteria that is external to the feelings of the mind of the person doing the evaluation. Of importance in objective scoring is the use of evaluation techniques which make scoring as non-biased as possible.

Several descriptions of evaluation techniques as well as detailed examples are contained in this support document.



EVALUATING THE PROCESS SKILLS

When constructing evaluation to identify students who have specific inquiry skills, first have in mind what a student can do with that skill. Secondly obtain some understanding of the science context that is being evaluated. With this understanding, the next steps will be to:

1. write the objectives of the science lesson.
2. determine the tasks from which inferences can be made about the student's learning.
3. design a test or activity that gives students the opportunity to demonstrate specified behaviours.

4. establish standards by which to judge whether the students have obtained the objectives.
5. give the test, correct it, match the student's test performance with the pre-determined expectations, and determine whether the students have attained the objective.

The test might be in two parts. Part one deals with the demonstration of the skill(s) while part two allows for verbalization or articulation of the skill(s). The student could be allowed to describe orally or in writing the salient features associated with the skill(s).

For example

1. The objectives of the lesson might be:

"To develop increasing competence in classifying objects into general categories or groupings"

2. The tasks from which inferences can be made about the student's learning might be:

"The student when given from 10 to 12 objects should be able to classifying or sort them into well defined categories or groupings based upon the response to a simple yes or no question (i.e. dichotomous key)."

3. The test or activity that gives the student the opportunity to demonstrate specified behaviours might be:

"The student is given approximately a dozen objects by the teacher. The student is asked to place the objects into two groups based upon the answer to a question about the object. The student proceeds to ask questions concerning each grouping until there is no more than two items in any one group."

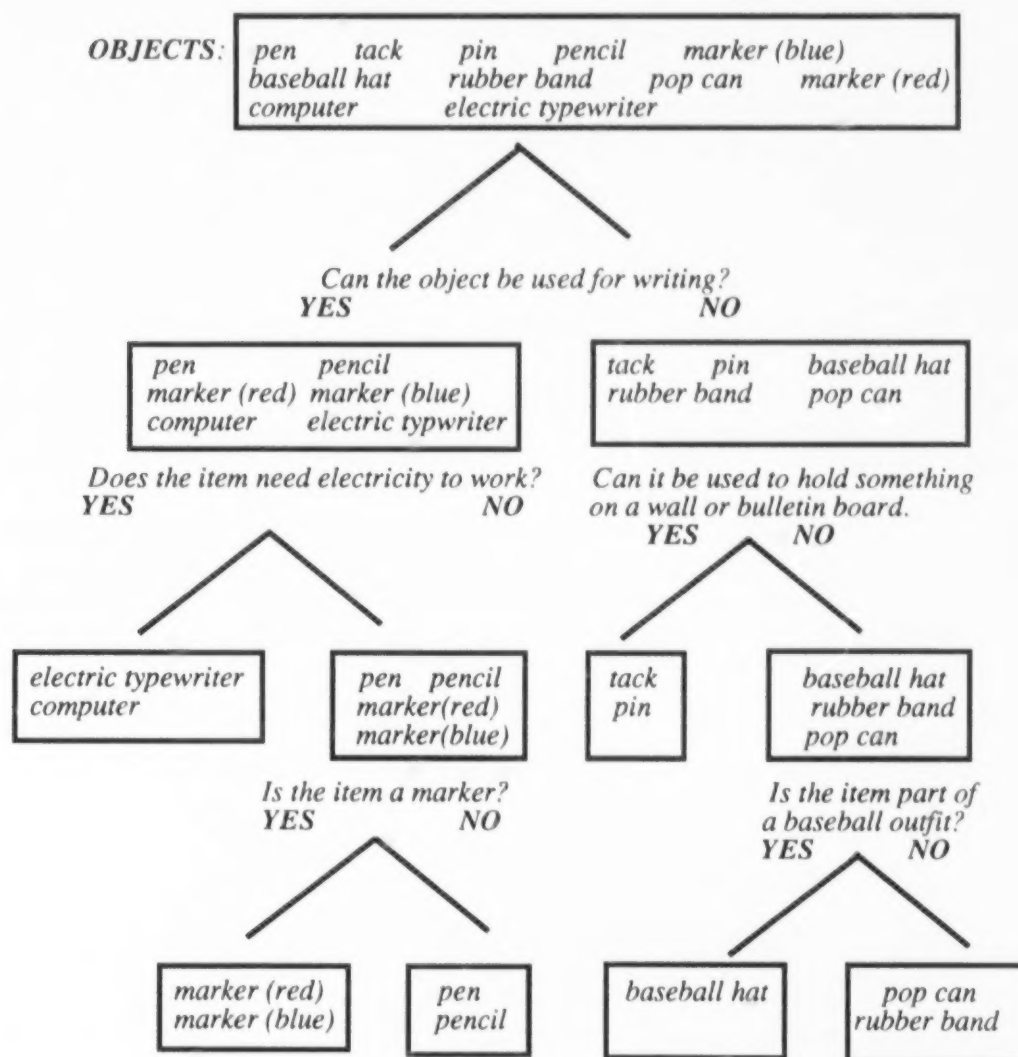
4. The standards which judge whether the students have obtained the objectives might be:

"The student should be able to sort the items into at least five or six well defined and defensible groupings."

5. Give the test, correct it, match the student's performance with the pre-determined expectations, and determine whether the student has attained the objective.

"You might have individual students perform the activity and as they do, have them tell you exactly what they are doing and why. This activity could also be done on pencil and paper but you should keep in mind the value associated with having students articulate (verbalize) their actions."

A student's written response might look like this.



PROCESS SKILLS AND THEIR ATTENDANT BEHAVIOURS

For each of the following process skills, there are specific student behaviours which will indicate to the teacher that the student has achieved increased competence in that skill.

Observing	The student has increasing competence in using the senses of sight, hearing, touch, smell and taste as well as mechanisms for extending these senses.
Classifying	The student develops increasing competence in grouping articles, objects and ideas based on observable properties.
Communicating	The student is increasingly able to describe an experiment so that an individual who has not seen it can carry it out.
Quantifying	The student has increasing competence in measuring length, weight, volume, and rate of change of physical phenomena.
Formulating Hypotheses	The student develops increasing competence in making a hypothesis regarding causes of a phenomenon or the relationship between two variables.
Defining Terms Operationally	The student demonstrates increasing competence in stating basic procedures or characteristics in order to identify the subject being defined.
Controlling and Manipulating Variables	The student has increasing competence in arranging conditions so as to be able to control and manipulate objects or conditions in an experiment.
Interpreting Data	The student develops increasing competence in getting the most out of data without oversimplifying, drawing conclusions supported by the data, and considering alternative explanations.
Inferring	The student has increased competence in drawing more than one inference from a set of data, demonstrating that an inference can be tested by applying known tests to the properties of objects. The students should display the ability to distinguish between observations and inference.
Formulating Models	The student has increasing competence in building both physical and mental models to account for phenomena.
Predicting	The student has increasing competence in conducting experiments to test predictions of relationships between two measurable quantities.
Experimenting	The student has increasing competence in planning, conducting and communicating experiments in which the problem is clarified, hypotheses are stated, observations are made, and data is interpreted. This process depends upon the student's ability to use all of the other processes.

CHECKING THE GROWTH OF INQUIRY PROCESSES

Often, the growth in attainment of process skills manifests itself in the behaviours of the students. The following list indicates some things which students might do which will indicate that they are "growing" and internalizing the inquiry process:

1. Suggests a prediction.
2. Offers ways of testing prediction.
3. Changes opinion for better idea.
4. Selects materials with purpose.
5. Uses "I think", "I don't know."
6. Criticizes his own work.
7. Observes carefully.
8. States relationships while observing.
9. Repeats work and/or changes for better procedures.
10. Uses data to draw inferences.

EVALUATING AN INVESTIGATION

The following is a checklist of basic questions which a teacher can ask of most experiments or investigations to extend the learning experience, or to focus the attention of students on evaluating the learning experience:

1. What helped you most to find an answer to our question?
2. What could have been done better?
3. What new ideas did we discover?
4. What new words did we learn?
5. If you tried the experiments at home, were the results the same as in school?
6. What predictions were we able to test with the materials we had?
7. What different ways could we have kept records of our observations?
8. What materials and equipment helped us most?
9. What equipment did we have to construct?
10. How did we use numbers and measurement to help us find answers?

DETERMINING ATTITUDES

Informal evaluation methods which can be used to determine the presence or absence of particular attitudes and behaviors are essential. They are, however, the most difficult to devise. The most practical approach is for the teacher to be conscious of the expected behaviour and to make a subjective evaluation.

Informal evaluation is most suited to attitudes, interests, and appreciations.

A more specific evaluation of attitudes is possible by considering the following attitudes and their attendant behaviour indicators:

1. Curiosity

- a. Expresses a desire to investigate new things or ideas.
- b. Expresses a desire for additional information.
- c. Asks for evidence to support conclusions made from scientific materials.
- d. Expresses interest in scientific issues in the public domain.
- e. Expresses a desire for explanations.

2. Openness

- a. Demonstrates willingness to subject data and/or opinions to criticism and evaluation by others.
- b. Seeks and considers new evidence.
- c. Expresses the realization that knowledge is incomplete.
- d. Expresses understanding of the tentative nature of conclusions as products of science.

3. Reality Orientation

- a. Demonstrates understanding and acceptance of limitations.
- b. Expresses awareness that change is the rule rather than the exception.
- c. Expresses awareness of several sources of knowledge.
- d. Expresses awareness of the fallibility of human effort.
- e. Expresses belief in science as a means of influencing the environment.
- f. Does not alter his data.
- g. Demonstrates the realization that research in science requires hard work.
- h. Demonstrates awareness of the limitations of present knowledge.
- i. Expresses awareness of the historical development of patterns of inquiry and of the processes and characteristics of science.
- j. Demonstrates belief that the search for desirable novelty should be tempered by awareness and understanding of traditional concepts.

4. Risk-taking

- a. Subjects self to possible criticism and/or failure.
- b. Expresses opinions, feelings, or criticisms in spite of the presence of authority.
- c. Participates freely in class discussions.
- d. Indicates a willingness to try new approaches.

One way which teachers can gauge a change in student attitudes is to imagine each of the science attitudes along a continuum ranging from "no behaviours associated with that attitude" to "exhibits many behaviours associated with that attitude".

exhibits no behaviours
associated with the attitude

exhibits many behaviours
associated with the attitude

5.Objectivity

- a. Indicates a preference for statements supported by evidence over mere opinion.
- b. Indicates a preference for scientific generalizations that have withstood the test of critical review.

6.Precision

- a. Expresses a demand for coherent statements.
- b. Seeks definition of important words.
- c. Demonstrates sensitivity to the appropriateness of general and/or specific statements in a given context.
- d. Expresses the need to examine a problem from more than one point of view.

7.Confidence

- a. Expresses confidence that success can be achieved through inquiry.
- b. Demonstrates willingness to take "intuitive leaps".

8.Perseverance

- a. Pursues a problem to its solution or to a practical point of termination.

9.Satisfaction

- a. Expresses satisfaction with the process of inquiry.
- b. Expresses confidence that the inquiry experience will enable future goals to be attained.

10.Respect for Theoretical

- a. Demonstrates awareness of the importance of models, theories, and concepts as means of relating and organizing new knowledge.
- b. Demonstrates awareness of the importance of currently accepted theories and concepts as a framework or basis for the emergence of new knowledge.
- c. Demonstrates awareness of the importance of scientific procedures for the generation of new knowledge, theories and concepts.

11.Responsibility

- a. Is active in helping to identify and establish learning goals.
- b. Demonstrates willingness to work beyond the assignment.
- c. Insists upon adequate evidence on which to base conclusions.
- d. Suggests changes to improve procedure.
- e. Shows respect for the contributions of others.
- f. Demonstrates willingness to share knowledge with others.
- g. Offers rationale for criticism.
- h. Initiates action for the benefit of the group.

12.Consensus and Collaboration

- a. Demonstrates willingness to change from one idiom, style, or frame of reference when working with others.
- b. Calls upon other talent from within the group when opinions and help are needed.
- c. Seeks clarification of another person's point of view or frame of reference.

Another method used to gauge a change in student attitudes is to utilize a chart format which lists behavioural indicators and checks them against suitable descriptors.

	Constantly	Frequently	Occasionally	Rarely
•				
•				
•				

IMPRESSIONISTIC SCORING

This approach deviates considerably from traditional quantitative scoring to qualitative scoring. A teacher can develop a scoring scale with qualifying statements describing the expected achievement for various points along the scale.

Impressionistic scoring is readily adaptable for scoring:

- written assignments
- essays
- reports
- completeness
- consistency
- participation
- attitude
- lab technique
- a specific skill
- etc.

Usually a five point sliding scale is used. At report card time, one can use the information gathered to report what the student is able to do.

Scale

- 5 correct/excellent/accurate/effective
- 4 mostly correct/well done/
relatively error-free
- 3 satisfactorily done/evidence of
some distracting errors
- 2 evidence of incorrect data/
efforts made but requires
assistance
- 1 insufficient data for scoring

SAMPLE IMPRESSIONISTIC SCORING CRITERIA

CRITERIA SCALE	DATA	POSSIBLE CHOICES FOR EVALUATION		
		ENGLISH GRAMMAR ORGANIZATION	COMPLETENESS CONSISTENCY	ATTENDANCE ATTITUDE PARTICIPATION
5	correct	excellently done accurate & effective		excellent
4	mostly correct	well done relatively error-free		very good
3	somewhat correct	satisfactorily done evidence of some distracting errors		satisfactory
2	evidence of incorrect data	efforts made requires assistance		unsatisfactory
1		Insufficient Data For Scoring		

PROJECTS

Projects are assignments given to individual students or to a small group of students. Usually they involve research on a specific topic within the program.

Projects allow students some freedom to express individuality and to demonstrate particular strengths.

A variety of resources can be incorporated into a project, e.g.,

- written report
- models
- audio-visual material
- photographs
- drama
- drawings
- graphs

It is important to structure the project carefully, and define the requirements clearly to ensure that it is manageable.

Requirements should indicate:

- the objectives of the report
- completion date
- how the teacher will evaluate it
- where to find information
- format/basic requirements

ANECDOTAL RECORDS

Anecdotal records are brief comments about the teacher's observations. The information recorded is factual and non-judgemental - the evaluation of what was seen is noted after the observation is complete. The comments should be specific and related to the objectives of the program. Record both positive and negative examples, e.g.,

"During the lab exercise, Jonas was very exacting whenever he used the balance beam to weigh the chemicals needed for the next stage of the experiment. He spent a great deal of time measuring out just the right amount of the substance being used. He spilled some on the counter and promptly cleaned it up with a paper towel. He also dropped and broke a glass container but failed to report the incident."

SELF ASSESSMENT

Students should also participate in the assessment process by identifying what they have learned from the lessons, what they are interested in, what they think is important for them to know more about, etc. One way of doing this is through a rating scale. For example, I learned:

a lot some things nothing

I was most interested in: _____

I would like to learn more about _____

I think I was well prepared for my presentation because _____

I think that I am getting better at _____ because _____.

Another method is to have the students write a self-assessment report and to provide them with focus questions such as:

1. What did you do when you were first given the problem?
2. What strategy did you use to solve the problem?
3. Did you try any approach which did not work?
4. Did you complete the assignment?
5. Did you check your work in any way?
6. Do you feel sure that your work is correct?

SELF RATING SCALE FOR ORAL PRESENTATIONS

The students can indicate how they feel about the following features of their topic, preparation and presentation by checking the appropriate areas. For each item listed, the student indicates their response along a sliding scale.

Topic	NOT AT ALL	A LITTLE	QUITE	VERY	EXTREMELY
Interesting to me	_____				
Interesting to audience	_____				
Appropriate for assignment	_____				

Preparation: I was able to:

- Find sufficient information
- Select the information that was appropriate
- Organize my ideas so the audience could follow easily
- Develop an effective opening
- Develop an effective closing
- Prepare useful note cards
- Practice until I was confident about my presentation

Presentation: I was able to:

- Feel confident and poised
- Speak clearly
- Speak with expression
- Make contact with the audience
- Use my notes effectively
- Follow the plans I had made

PEER EVALUATION

Teachers often find that when a project is being discussed by the students, the students are capable of identifying ways in which the project might be evaluated. They are able to identify categories to be evaluated as well as the amount of emphasis to be placed on each category.

When students have been involved in determining the assessment criteria for a project, they are more apt to follow that criteria as a guideline for presenting or displaying their project.

Students are also capable of providing peer feedback in the form of constructive

criticism concerning the reports, presentations or projects presented by their fellow students. Often, a short form or handout listing the criteria for assessment will help guide their feedback.

example:

_____ is a better organizer
(descriptor) now because
_____ (proof)

_____ is good at classifying
because _____ (proof)

_____ was well prepared because
he/she _____ (proof)

GROUP EFFECTIVENESS APPRAISAL FORM

Name _____ Group _____

Rate your group on a 1 to 5 basis

(1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent)

- | | |
|---|-----------|
| 1. We worked cooperatively with all group members. | 1 2 3 4 5 |
| 2. We accomplished what we set out to do. | 1 2 3 4 5 |
| 3. We were satisfied with our performance on this task. | 1 2 3 4 5 |
| 4. We used our group time efficiently without wasting or misusing time. | 1 2 3 4 5 |
| 5. We all contributed fairly in the completion of this group task. | 1 2 3 4 5 |

Personal assessment and observations (students can write responses on a separate sheet of paper which can be stapled to the form)

1. Did you feel satisfied with your own participation in this project?
2. Do you think that the project participation was fairly equal?
3. Do you think there are some ways your group could have improved and therefore produced a better finished project?
4. Do you like doing a project like this or do you prefer to work on your own?
5. Please add any helpful comments you may think of:

EVALUATING GROUP WORK

When evaluating individual students who work in groups, do not try to look at all the students during each session. Focus on two or three of the students and a particular skill or aspect about which you want information. Gradually over a period of time, all students should be assessed relative to a particular skill or process. A checklist may help you to focus your evaluation activity and help you to gather the information which you observe over time.

OBSERVATION	number of observations	reasonable expression	difficult/ anti-social	prominent individual
A. During Group Work				
as a listener				
as a reader				
as a contributor				
B. Working Independently				
initiative				
frustration				
engagement				
C. In a Large Group				
attention				
comprehension				

GUIDELINES FOR CONSTRUCTION OF TEST QUESTIONS

The following are simple guidelines for teachers to use when constructing what many refer to as "paper and pencil" tests.

Multiple Choice Items

1. Each item should reflect an important learning outcome.
2. Present a single problem in the core of the item.
3. Use simple clear language.
4. State the problem in positive form wherever possible.
5. Underline negative wording wherever it is used.
6. Make certain that the intended answer is clearly best.
7. All alternative answers should be parallel in form to the intended answer.
8. Vary the length of the intended answers to eliminate length as a possible clue.
9. Vary the position of the intended response.
10. Each item should be independent of other test items.

True-False Items

1. Only one central idea should be in each statement.
2. Wording of the statement should be very precise.
3. Statements should be short and use simple language.
4. Avoid the use of double negatives and excessive use of negatives or words such as always, never, sometimes, and usually.
5. Avoid extraneous information.

Short - Answer Items

1. The question should be stated so that only a single, brief answer is possible.
2. Avoid giving extraneous information.
3. Use incomplete statements only when the meaning is perfectly clear.

Matching Items

1. Keep the list of items short.
2. Brief responses should be kept on the right when using a left/right column format.
3. Use more or fewer responses than premises.
4. Permit some responses to be used more than once.
5. Specify clearly in the direction the basis for matching.
6. Indicate that each response may be used once, more than once or not at all.

Essay Test Items

1. The teacher's expectations should match the student's writing ability.
2. Ask well defined questions, not broad, general questions.
3. Indicate exactly what the student is to do.
4. Indicate how long the response should be.
5. Know beforehand what comprises an acceptable response to a question.

NOTES AND REPORTS

The taking of notes and the writing of reports is a vital part of most science courses. The student's notebook should contain the essence of what they are expected to learn and understand.

Notes should:

- be neat
- be well organized
- be distinct
- use sequential headings
- include lists and summaries
- include diagrams, graphs, etc.
- reflect correct spelling
- reflect correct grammatical structure.

Not all writing exercises need to be evaluated. There are times when grammar and mechanics are de-emphasized in favour of the writing process.

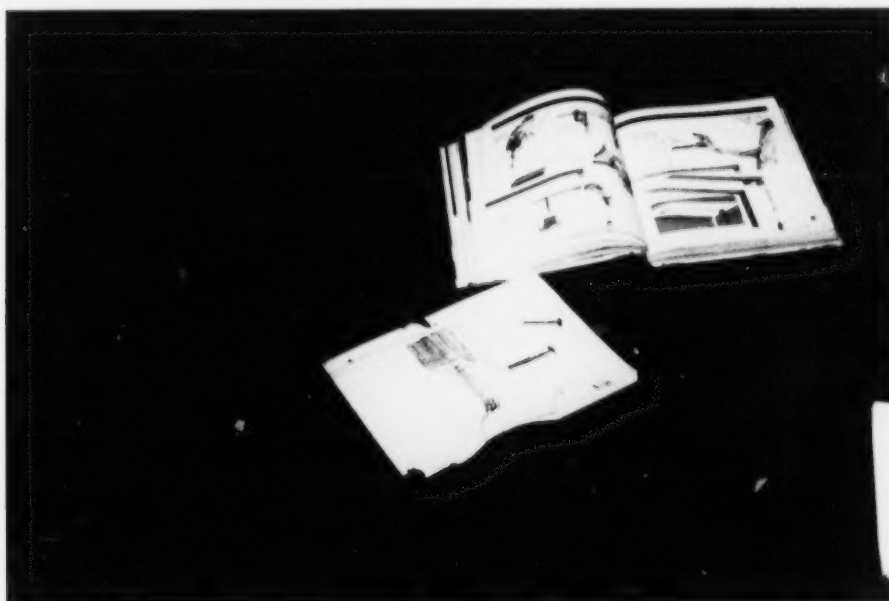
There are several strategies which teachers can use to assist students in note taking, in focusing their attention on what is occurring in the science class, on what they have learned and on what or how they feel about it.

Lab Reports

A three stage process for writing major lab reports is recommended:

Pre-write	lab activity is performed using rough notes
Write Phase	reaction to what they have written is sought; debriefing of the lab individually or on a class basis; followup to the lab
Re-write	formalized report using a standard format

A major lab report format is not used in a lab per day setup, but could be used as often as once per week or every two weeks.



Format For Reports

There are many formats which could be used by students when writing up a lab report. Most formats are quite similar to this one. Differing terminology for each stage is suggested. A sample investigation is used.

Problem/Question

A question or problem is posed.
(How many drops of water can be placed on a penny?)

Hypothesis/Guess

Usually this section contains an educated guess, and a reason why it is the best guess.
(I think that 40 drops of water can be placed on a penny because a drop of water is quite small and the surface of a penny is pretty big.)

Apparatus/Materials

A list of the materials used for the investigation, sometimes includes a diagram.

Procedure/Method

Student identifies the steps that were followed.

Observation/Results

The student records what occurred, sometimes using a chart, graph, etc.

Conclusion

The student refers back to the hypothesis and indicates what has been found. In so doing, the problem/question which was originally posed is resolved/addressed.
(I thought that 40 drops of water would fit on a penny but I could only get twenty-two drops of water on my penny.)



Learning Log Entries

Students can be encouraged to make entries in a science "log" or journal about twice a week. Students comment on what they have learned and what they still are having difficulty with. When the teacher examines the journals, he/she should focus on content, not grammar. The student's comments will tell the teacher what worked, what did not work, and what still needs to be re-examined.

When students make entries, so should the teacher. The teacher should model the behaviour. Both teacher and student comments may be of value when the teacher looks back and does an assessment of the unit. This exercise could also be used as an initial assessment exercise to see what students already know on a certain topic and where the class is as a whole.

science log ... October 22nd

I have learned a lot about acid rain but I'm still not too sure how it affects the North. Its made from gases that dissolve in water and falls back to the Earth as rain. It affects trees and living things in water.

Its hard to imagine that something that you can't see can do so much harm. We measured snowfall for its pH level and found out that it was 6.7 - that means that we have acid rain too.

I think that scientists should do studies to see how it might be affecting us up here.

Reading and Note Taking

There are two formats for note taking to accompany reading which are often used. In both cases, the page which the student writes on is divided into three columns. This process works well with shorter passages (8-10 paragraphs)

Summary

1 or 2 sentences for each paragraph

List of vocabulary words

Comments or question on content

Based on a reading from Science Directions (7), page 154.

Acid rain is a serious threat to our environment.

It is produced when various gases in smoke and exhausts dissolve in water droplets in the air. When it rains, it is acidic. Acid rain can dissolve minerals and damage living things.

Scientists think that acid rain is hurting our forests and killing our lakes.

carbonic acid

sulphuric acid

nitrous acid

emissions
pH level

reservoirs

Its hard to imagine acid rain from down south affecting us here.

I wonder if acid rain affects our fish or the food that the caribou eat - lichens and mosses.

I think studies should be done up here.

Another format which is popular is illustrated below.

Summary	Student Reaction	Teacher Column
1 or 2 sentences for each paragraph	or commentary to that paragraph Students get involved in own learning	Occasional comments or reaction to student comments or summary

Based on a reading from Science Directions (7), page 154.

Acid rain is a serious threat to our environment.

Its hard to imagine acid rain from down south affecting us here.

It is produced when various gases in smoke and exhausts dissolved in water droplets in the air. When it rains, it is acidic. Acid rain can dissolve minerals and damage living things.

I wonder if acid rain affects our fish or the food that the caribou eat - lichens and mosses.

Perhaps we could measure the pH level of our rain or snowfall to see if we get acid rain in our community.

DK

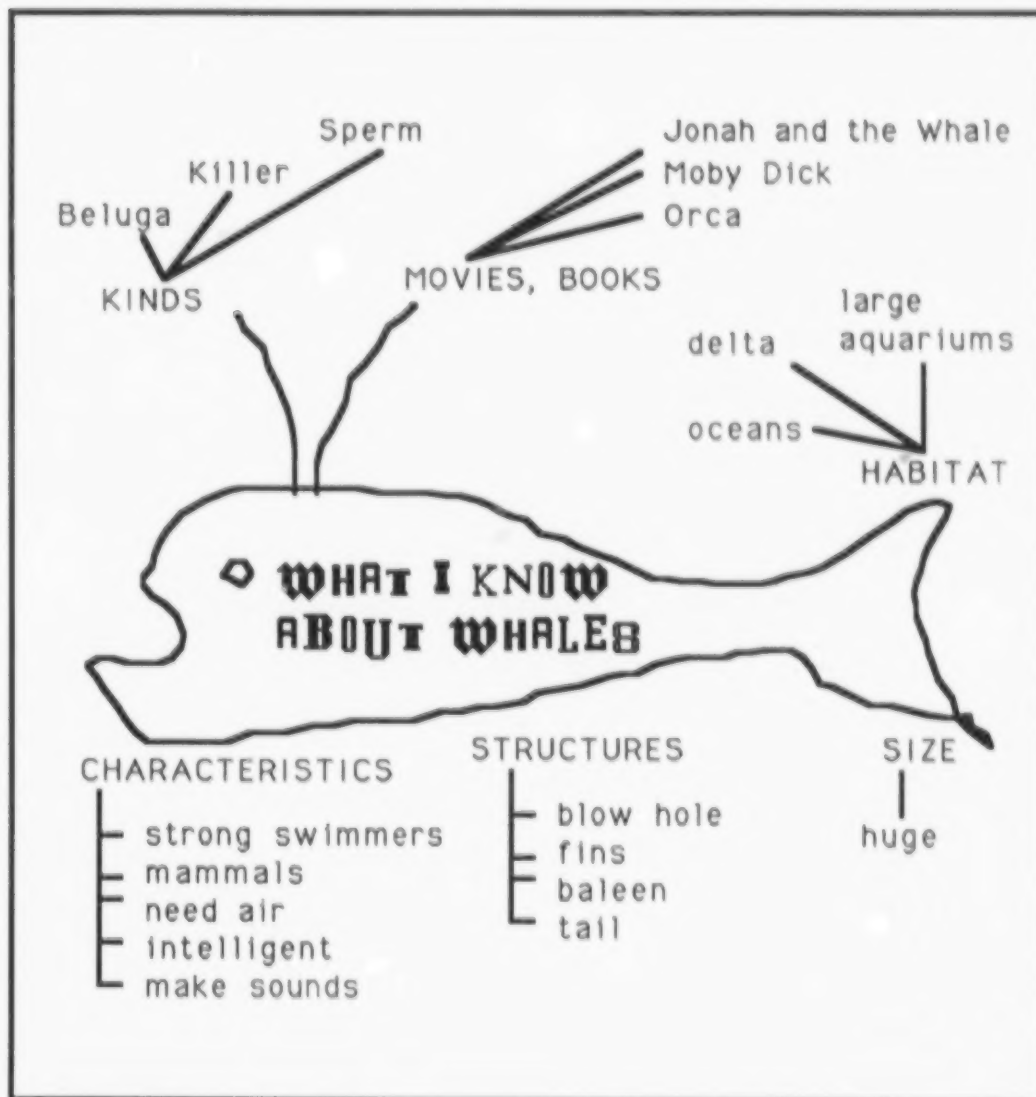
Scientists think that acid rain is hurting our forests and killing our lakes.

I think studies should be done up here.

Semantic Mapping

With this strategy, students make conceptual maps of course contents. In many cases, students can employ an artistic bent in their work. It can also be used to determine what a student knows about a topic before you begin teaching

about it. This enables you to gear the materials to what they need to know and avoids duplication or wasting time on concepts which the students are already familiar with.



Dialectical Notebooks

Using dialectical notebooks, both the teacher and the student enter into a dialogue by writing a note about, or a summary of a page or section which has just been read. Each page of the dialectical notebook must be divided into two columns. Alternatively, facing pages can be used. A quick summary of the page which has been read is put on the left side while questions,

comments and concerns about the passage are entered on the right hand side of the page. The teacher and student share comments with each other and encourage one another to question, debate, and critique what they have read and how they feel about it. Using this approach, reading and writing become a two way process.

Based on a reading from Science Directions (7), page 154.

Summary

Acid rain is a serious threat to the environment in many parts of Canada. It gets in the water and damages buildings.

A gas given off by living creatures or from the burning of fossil fuels dissolves in water droplets and forms the acid rain. Acid rain can kill living things like plants and fish.

Questions, Comments,

I wonder if acid rain affects larger animals like caribou or the food that they eat - lichens and mosses.

Will our fish in the north be affected by acid rain?

That's a good question. Do you think that the larger or smaller fish would be the first ones affected?

Maybe we could try to measure acid rain in our water or in our snowfall.

DK

Scripting Plans and Process

This strategy involves thinking about the processes involved in solving a particular problem, writing them down, and evaluating their effectiveness. Students are encouraged to write about the strategies which they plan to use to solve a particular problem(s) and the steps which they will take to solve them (could also be done after the fact). They can also list the questions they might have about the problem and the possible solutions. These can be responded to or added to as the inquiry

progresses. After the Inquiry is complete, all of these notes will have provided them with an excellent study and review base, but will also have laid the ground work for a "finished" piece of student writing in science.

Using this strategy, students discover concepts for themselves, share their solutions and learn that other students have shared concerns and difficulties.

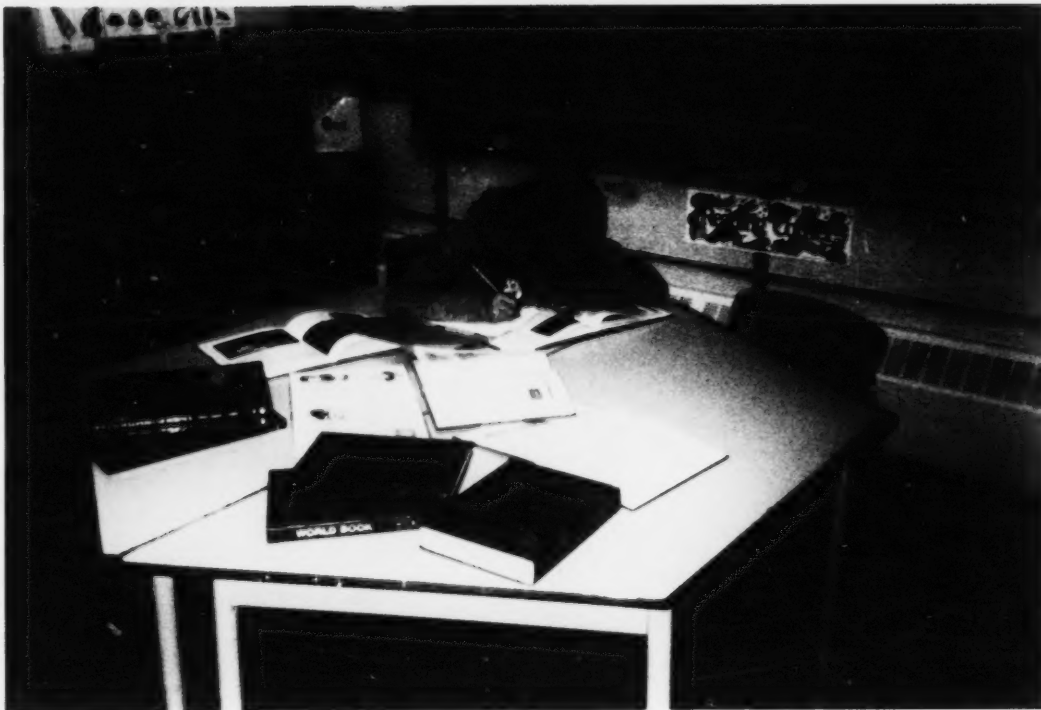
PROBLEM: How to determine if my community gets more acid rain than another community in my region.

STRATEGIES:

- 1) I need to know how to measure for acid rain.*
- 2) I need to contact another school and get them to measure for acid rain as well.*
- 3) I have to make sure we measure at the same times and then compare our results.*

STEPS:

- 1) I can use litmus paper to test rainfall or melted snow for its pH level.*
- 2) I can contact another school by phone or Internet to see if they are interested. Maybe I can get a lot of schools if I put my message on Internet.*
- 3) I should make sure we test over the same time period.*
- 4) We should arrange a way of sharing the information we gather.*



The teacher should take time to assess what has taken place after a unit/topic has been completed. The end result is basically to determine what you would do differently if you taught the unit a second time. Among things to consider:

How was the unit introduced?

How did you catch their interest?

Were the students easily motivated?

Would you introduce the topic in the same manner the next time you repeat this lesson/unit/topic?

Can you think of other materials that you might use next time to introduce the unit?

How were you able to determine what the students already knew about the topic?

Did you allow the students to discuss their experiences regarding the topic?

Did you encourage the students to identify questions which they would like answered during the unit?

Progression through the unit

Did you have set goals in mind regarding what you would like to accomplish?

Did your lessons follow each other systematically?

Would you change the order of topics if you were to repeat the unit?

Did you use activities which were geared to the experiences and the language level of your students?

Were your students able to make personal associations with what is being taught?

Did you use a variety of resources?

Are you observing things about your students which will be used for evaluation purposes later on?

Did you evaluate using a variety of techniques during the unit?

Were all the lessons successful?

Why do you think they went so well?

Did any of the lessons "bomb?"

How would/could you change those lessons?

Did the students have difficulty with any of the lessons in particular?

Were some concepts easier for the students than others?

Would/could you have dealt with any of the topics in any other manner?

Concluding the Unit

What culminating activities did you use?

Were you able to "pull it all together" at the end of the unit?

Were the students able to apply any of the new learnings?

Did you review with the students all the key points that you covered in the lessons?

Are the students aware of how they have been evaluated and how a final mark in this unit will be determined?

Is your evaluation plan consistent with the goals of your lesson?

Reflecting on the unit

Overall, were you pleased with the learning experiences which you provided?

How do you think the students liked the experience?

Have you asked the students for comments on what they have learned?

Were you able to use culturally relevant content to illustrate the concepts?

How did you incorporate skills and attitudes as well as concepts into your lessons plans.

How were you able to incorporate the curriculum emphases (nature of science, science and technology, societal decision making) into your unit?

Were you able to extend the learning experience? raise new issues? apply the learning to new situations?

Were your students able to present and share the information learned to a wider audience?

Were your students able to take the information learned and reconstruct it in another medium? (drama/poetry/drawings/models/songs/short story)

CLASSROOM ORGANIZATION AND MANAGEMENT

In this science program, the student learns by becoming an active participant in the learning process. This learning process takes a variety of forms including viewing, listening, reading, writing and discussing as well as direct hands-on learning experiences.

The teacher's role is mainly to guide and manage the total learning process rather than to be the primary source of information. Effective management of the science classroom is critically important to the program's success. Following are some suggestions for effective management that have been found to be helpful:

1. Be well prepared

- check that all needed materials are available for each activity
- become familiar with each activity by trying it out in advance
- prepare and assemble materials in advance.

2. Use a variety of materials and approaches

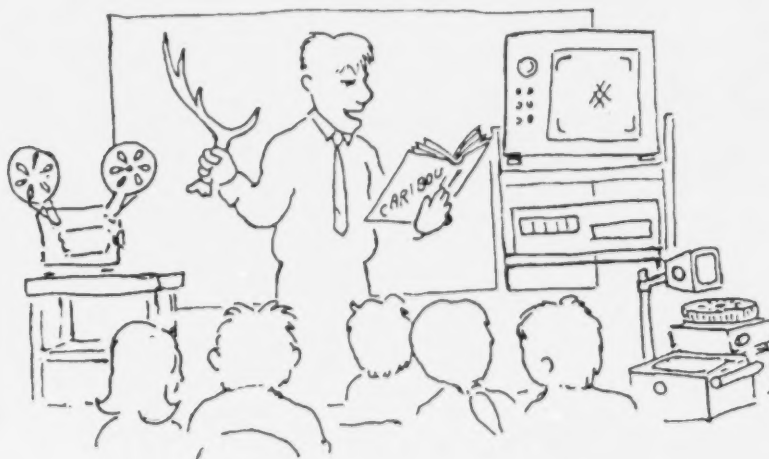
- combine investigative problem

solving activities with the special related language skills of listening, reading, writing, and speaking

- use a variety of manipulative materials and equipment
- use reading materials for supporting and reinforcing learning
- use audio-visual materials for introduction, reinforcement and extension of learning activities.

3. Establish routines

- establish routines to handle events that come up regularly rather than deal with every event separately. Routines should be established for:
 - where materials are stored
 - how materials are to be gathered and used
 - how groups are to be formed
 - how groups should work
 - clean-up procedures
 - format of written work, etc.
 - safe practices and procedures
 - student conduct.



SAFETY IN SCIENCE

The "just in time" attitude can lead to poor and sometimes unfortunate results in science education. Often the common sense reactions are overridden by the desire for expedience. The electrical octopus, the sharp pointed scissors, the wet hands switching off the lights, the matches left behind, and the desks pushed in front of the door are but a few of the "mistakes" that one can make when in a hurry. Young children, however, do not distinguish between the exception and the rule.

It is the responsibility of the teacher and the school to provide a safe working environment. It is imperative that the teacher instills in the student a respect for the inherent dangers of science activities. It would be remiss to assume that safety procedures are limited to the discipline of science: the shop, the gym, the cooking area, the hallway and the playground are all potential disaster areas when disorganization, loose procedures, poor supervision and disregard for accepted procedures abound.

Safety guidelines represent one small step in assuring that our science rooms are places in which the student:

- learns,
- accepts responsibility for self,
- accepts responsibility for others, and
- inculcates safety habits in daily lifestyles.

The National Science Teachers' Association has identified the following safety considerations which teachers should check and/or establish prior to teaching science.

Accident: Notify the principal, nurse, parents, family and physician.

Animals in the Classroom: Establish proper selection, cages, care and handling. Check on allergies of students.

Plants in the Classroom: Establish proper selection of non-toxic plants and handling procedures.

First Aid: Have a first aid kit readily available.

Field Trips: Establish parental permission, supervision, and equipment needs.

Fire: Establish or locate extinguishers, alarm box, other fire fighting aids, and evacuation procedures.

Use of Restricted Chemicals: Avoid using concentrated acids and bases, volatile liquids, active metals and restricted chemicals, eg., mercury and known carcinogens.

Health Hazards: Establish procedures to avoid hazards related to bacterial and other biological specimens.

Storage and Labelling of Materials: Establish a storage space, labels for stock, and procedures for discarding chemicals.

Safe Use and Care of Equipment: Select approved equipment, establish maintenance procedures, and develop safe techniques regarding use.



SCIENCE FAIR INFORMATION

Philosophy

As educators, we must keep the students as the focus of education. Each student starts at a different place and will learn a different amount. There will be a range of interest and ability in every classroom.

Science is teaching information and it is teaching a process. Education starts where the student is. The scientific process has abstract parts. The use of controls and the limits on meaningful data are not obvious. Understanding the scientific process is a learning experience and a Science Fair helps in that development. Don't expect the student to totally understand the process in the first or second year.

Students are interested in the world around them. A science project channels the students natural scientific interest into a project.

Each subject area has assignments. In science, at least one of the assignments should be "a doing," "a manipulative," a "hands on" investigative assignment, (preferably an experiment or demonstration experiment).

Why Have A Science Fair?

A Science Fair has the potential for achieving many objectives, both for the individual participants and for the school as a whole. The following are some of the main objectives:

For The School

To provide an opportunity for students to share their own learnings with each other.

To provide a benchmark for student achievement that can be understood by parents, students and teachers alike.

To provide a social event with a positive educational flavour.

For The Individual Student Participant

To provide an opportunity for students to take an initiative in their own learning.

To develop a sense of personal self-worth among participating students.

To develop science knowledge and understandings.

To develop skills in using science processes (e.g. observing, classifying, measuring, recording data, experimenting, etc.)

To learn more about science and its conceptual framework and have fun doing so.

Types of Projects

Research and Experiment Oriented Projects

These are projects that involve testing the effect of one thing on something else. In its truest form, it consists of forming a hypothesis and then testing the hypothesis experimentally.

Observational Projects

These projects involve the observation and recording of a phenomenon and the use of current knowledge to explain it.

Historical Projects

The classical experiments of science can be rediscovered and presented as a valid project. They could be exact copies of the original or perhaps with slight modifications.

Design Projects

These projects involve the design, development and demonstration of a new approach to a technical problem.

Display Projects

With these projects, one explains the tools or principles of science.

Theoretical Projects

These projects illustrate or demonstrate theoretical concepts, e.g. what would the effects of an additional planet have on the orbits of the known planets of our solar system.

There seems to be different levels of expertise required on the part of the student, but don't be disappointed if the first timer to Science Fairs starts off with a collection, model, display or research project. Encourage a move up to a demonstration or scientific inquiry process the next time around. After all, we do have to start someplace.

A Good Project Will Have:

A clear statement of the question asked.

A clear statement of what the student feels the answer to the question will be - and why!

An outline of the experimental design-material needed, variables involved, controls implemented.

A summary of experimental results.

An attempt to explain the results, and what they mean in relation to the original question and the student's prediction.

Judging

Judging can be based on a percentage point mark with each aspect of the presentation earning points towards a cumulative total. The weighting of the marks for each aspect will depend on how you have prepared your students for their displays. Some criteria for judging are as follows:

Scientific Thought

Clearly stated problem.

Control of variables

Adequate data to support conclusions

Originality

In terms of construction or design of equipment, interpretation of data

Skill

Ability of student to do project

Did student do project on own?

Skillful use of information

Workmanship

Dramatic Value

Attractiveness of project

Does the display explain itself?

Multi-sensory aspect of project

Written Summary

Is all required information provided?

Has the student expressed him/herself well in written material?

How much was prepared with assistance of others?

Are the important phases of the project presented in an orderly manner in the report?

Additional information is available in a kit prepared by the Science Institute of the N.W.T. entitled "Why Do Walruses Turn Pink?"

The Science Institute also provides the following services:

Dial An Expert

Information/Research Referrals

RESEARCH AND REPORTING SKILLS

One of the aims of the Junior High Science Program is that students should be able to independently find and use information for themselves. They should understand and demonstrate the skills of locating, organizing, evaluating and reporting information.

In order to achieve these objectives, library research skills need to be developed as part of your program. Many small schools lack library facilities. A good library/book centre at the back of the room can be established. Students should receive instructions which enable them to make use of as many resources as are available to them.

If you do have a library, success will depend upon the co-operative efforts of the librarian and the teaching staff.

In either case, gather together a collection of Science related books which coincide with the topics being taught. Having these in your classroom will provide motivation, enrichment and interest. The teaching of research skills may be part of your science instruction or, if you are lucky, it may be a part of your scheduled library instructional program. The nature of the program could be one of individualized instruction where each student advances to the next step once the previous skill has been mastered or it might be a group task-orientation.

Look For Print and Non-Print Materials

Encyclopedias	Card
Catalogue	Almanacs
Yearbooks	Handbooks
Dictionaries	Tapes
Audio-Visuals	Slide/Film
Micro-Computer	Filmstrips

Find Supporting Materials

Pamphlets	Atlases
Clippings	Globes
Magazines	Newspapers
Picture Sets	Models
Displays	

Skills Needed In Producing A Good Report

There are many special skills that students need as they learn to report projects effectively. The most basic one is how to locate information - eg. what are the possible sources of information that are available to me? The student also needs to be able to sort through the available information and decide which information is relevant and which is irrelevant. The determination of extraneous information is a highly valued skill required in many subject areas.

Students must also learn to write the newly found information in their own words. Once all the data has been collected, the next step is to arrange the data in a logical fashion.

Finally, the student must choose a suitable format for indicating which reference books were used eg. bibliography.



MAGAZINES/CLUBS FOR JUNIOR HIGH STUDENTS AND TEACHERS

There are several magazines available which are suitable for students, for teachers, or for both. Most magazines for students address a wide range of reading abilities and levels of comprehension. Many magazines also provide teacher editions to accompany the student versions.

Students should be in a resource rich environment. The teacher may want to order some of the following magazines to supplement books/materials from the school library which make their way into the classroom:

Alternatives Magazine - perspectives on science, technology and the environment. Cost \$15 for 4 issues. Available from Faculty of Environmental Studies University of Waterloo, Waterloo, Ontario N2L 3G1

Apogee - The Canadian Space Agency Newsbulletin Free, bilingual publication. Available from the Canadian Space Agency, Place Air Canada, 4th Floor, 500 Rene- Leveque Boulevard West, Montreal, Quebec H2Z 1Z7
1-514-496-4000

Bridges Magazine- for Canadian educators, focuses on science, technology, society issues. Available from Bridges, 2242 Lakeshore Blvd W., Toronto, Ontario M8V 1A5
(free quarterly journal)

Classroom Magazine
Scholastic - TAB Publications Ltd.,
123 Newkirk Road,
Richmond Hills,
Ontario L4C 3G5
(6 issues per year, \$23.95)

Countdown - space science and NASA activities including shuttle, satellite and rocket launches. Cost \$22 US for 12 issues. Available from Main Stage Publications Inc., Box 216, Athens, Ohio 45701

Current Science - latest in science news for junior high students. Cost \$5.99 US for 18 issues. Available from Field Publications, 4343 Equity Drive, Box 16630, Columbus, Ohio 43216

NASA Activities - administration and research type information, updates on NASA activities. Cost \$10 US for 12 issues. Available from NASA Activities, Superintendent of Documents, Washington, D.C. 20402

Odyssey - space exploration for grades 3 to 8. Cost \$19.95 US for 12 issues. Available from Nancy Mack, Kalmbach Publishing Co., Box 1612, Waukesha, WI. 53187

The Paper Crane
c/o Canadian Youth Peace Network,
555 Bloor St. W. - Suite 5,
Toronto, Ontario M5S 1Y6
(\$10.00/ year; target audience - general)

Science Activities - source of experiments, explorations and projects for K-12 levels. Cost \$38 US for 4 issues per year. Available from Heldref Publications, Helen Reid Educational Foundation, 4000 Albemarle Street N.W., Washington, D.C. 20016

Science and Children - meets general science curriculum needs of elem/junior high teachers - includes posters and overheads. Cost \$30 US for 8 issues per year; \$16 US for students. Available from National Science Teachers Association, 1742 Connecticut Avenue N.W., Washington, D.C. 20009

Science Challenge - environmental education for students at 7-12 levels. Cost \$4.95 US for 12 issues. Available from Curriculum Innovations Inc., 3500 Western Avenue, Highland Park, IL 60035

Science Dimension - news and issues in science for grade 7 and up. Free, available from National Research Council, Ottawa, Ontario K1A 0R6

Science News - summary of weekly news of science. Cost \$27.50 for 52 issues. Available from Science News Subscription Department, 231 W. Center Street, St. Marion, Ohio 43305

Science Scope - junior high journal including games, activities, posters, teaching tips and reviews Cost of \$43 US for 8 issues. Available from 1742 Connecticut Avenue N.W., Washington D.C. 20009

The Science Teacher
National Science Teachers Association
1742 Connecticut Avenue, N.W.
Washington, D.C. 20009-1171
(9 issues per year; cost \$43 US includes membership in NSTA; target audience - junior/senior high teachers)

Science Weekly - uses science content to integrate reading, writing, math, problem solving and technology at K-8 levels. Cost \$8 US per single subscription, \$3.95 per student for orders of 20+, Available from Science Weekly, Subscription Department, 2141 Industrial Parkway, Silver Spring, MD 20904

Science World Magazine
Scholastic - TAB Publications Ltd.,
123 Newkirk Road, Richmond Hills,
Ontario L4C 3G5 1-416-883-5300
(bi-weekly, 18 issues during school year; teacher and student issues; latest developments in science and technology with feature articles about science in the news and in everyday living; very interesting but American focus; target audience - grade 7 to 10))

Space Today - international space information regarding shuttle, rocket and satellite launches. Cost \$13.95 US for 8 issues; \$26 US for teachers editions. Available from Arcsoft Publishers, Box 132, Woodsboro, Maryland 21798

Super Science Magazine - Blue Edition
Scholastic TAB Publications Ltd.
123 Newkirk Road, Richmond Hill,
Ontario L4C 3G5 1-416-883-5300
(8 times a year during school year; student and teachers versions available; target audience - grade 4-6)

Sustainable Development Newsletter
Canadian Wildlife Service, Environment
Canada, Ottawa, Ontario K1A 0H3
(free; published 3 times a year)

Under the Same Sun
c/o Youth Editions, C.I.D.A., Box 1320,
Postal Stn B, Hull, Quebec J8X 9Z9
(free, for students ages 12-15, focuses on Sustainable Development)

Youth Science News (gr. 7 and up)
c/o Youth Science Foundation, 151 Slater
Street, Suite 904, Ottawa, K1P 5H3
(\$ 6.00 per year)

EFFECTIVE QUESTIONING TECHNIQUE

The essence of good questioning is to relate the questions directly to the skill or concept being developed. The skill or concept should be broken down into the fundamental concepts needed to accomplish the task. A determination must be made at each step as to what the student needs to know.

Clear statements or questions require careful thought on the teacher's part. Writing questions in advance is a good strategy for keeping them clear and concise. Your lesson plans should include sample questions. By being clear and concise, the student knows where to begin and where to end. If the student is not answering, or is misunderstanding the question, re-examine your question. Demonstrate flexibility in being able to edit your own questions.

Both concrete and abstract levels should be considered when preparing questions. Your overall goal is to develop critical thinking. Vary the level of difficulty to challenge the students appropriately. Having overcome a challenge, they feel good about the experience and their self concept grows. By asking questions that cause students to relate the key points of a lesson in their own words, you promote readiness in applying the concept being taught.

Most studies indicate that a wait time of three or more seconds will improve and strengthen student response to a question. Allow adequate wait time. Studies also indicate that failures to respond decrease and the number of unsolicited but appropriate responses by students increases when a proper wait interval is exercised. The time spent in waiting is easily outweighed by the improved responses that occur. Wait time can be an important element in your questioning technique.

Quite often we direct our questions to a few individuals only when we could and perhaps should be directing them to the

whole group. When this is done, all class members focus on the problem. When a question is directed specifically at one individual, other students tend to become inattentive. For example, saying, "I want all of you to think about this question" or "Each of you should be ready to describe your next move. In just one minute, I will ask one of you to describe yours", are examples of covert strategies for questioning. While covert strategies enable more students to participate mentally, the overall strategy is equally important - for it is an essential means of observing responses.

Often, even our carefully worded questions fail to produce the desired result. When this occurs, supply more information or restate the question. Asking the student what information is needed to answer the question is one technique to overcome obstacles. A second student may need to be involved to keep the lesson moving. By soliciting a response from a second student, you are assisting the first student in solving the problem at hand.

Your questioning techniques serve as a model for the students. Students should be encouraged to participate in questioning and thereby develop questioning skills of their own. Thinking skills will develop as students solve and make decisions on their own. Also, their ability to interact with each other increases.

Good questioning techniques can be an invaluable tool for today's teacher. It promotes total class involvement as well as individual success.

References:

- Rowe, Mary Budd. "Give Students Time To Respond" *Education Digest* (May 1978)
- Hunter, M. And D.R. "How Can I Plan More Effective Lessons?" *Instructor* (Sept. 1977)
- McCullough, D. and Findley, E. "How To Ask More Effective Questions" *Arithmetic Teacher* (March 1983)



ASKING GOOD QUESTIONS

You can use these questions to determine what experiences, language, and knowledge students have about a topic. You can also use the questions for assessing thinking processes throughout the concept development and application phases of each lesson and during the culminating and evaluation activities.

Questions For Assessing Experience:

1. Describe a situation where you _____?
2. What do you know about _____?
3. Have you ever seen _____?
4. Have you ever experienced _____?
5. Have you ever been _____?
6. Have you ever done _____?
7. Has something like this ever happened to you?
8. When was the last time you _____?

Questions For Assessing Language:

1. What do you think these words mean?
2. Can you give me another word that means _____?
3. What comes to your mind when I say _____?
4. Have you heard of the word(s) _____?
5. What words can you think of when I say the word _____?

Questions For Assessing Thinking Process:

Cognitive Memory (details, information):

1. Who.....?
2. What are the facts?
3. What are the most important details?
4. What is the.....?
5. What do you mean by?
6. What is your interpretation of what happened? (What do you think happened?)
7. When?
8. Where?

Convergent/Generalizing (getting the main idea):

1. What are the main points?
2. Given the information, what is the main idea?
3. What is the single most important idea?
4. State the idea in one sentence.
5. Explain _____.

Structuring/Relating (arranging relationships):

1. Categories: Which group does that belong to?
How would you classify?
What type would you.....?
2. Comparisons: How are they alike? same? similar? identical?
3. Contrast: How is it different? in opposition to? unlike?
4. Cause and Effect: What will happen if? Why?
What will happen as a result of?

Diverging/Using/Applying:

1. What might happen if _____?
2. If you use that idea, what would it mean for _____?
3. Apply that idea to our (this) situation.
4. What would result if _____?
5. If you were given these facts, what would you do to _____?
6. How would it be different if we used this idea?
7. What could the advantages/benefits be if we applied this idea/process?
8. What do you think the (story/paragraph) will be about?

Evaluation/Judging/Valuing:

1. How do you feel about this idea?
2. What is your opinion?
3. What is the best _____?
4. Are you satisfied with that answer/plan? Explain
5. Can this statement be made? Why? Why not?
6. Out of all the information, what can be used to prove your point?
7. How would you judge?
8. What is your opinion or conclusion about the product/plan/idea?
9. Why did you think it worked/didn't work?
10. What is fact? What is opinion?

STUDY SKILLS

When discussing study skills with students, it is best to start from the perspective of personal work habits. Topics considered could include:

- planning of study time
- having a place to study
- keeping homework up to date
- keeping your mind on your work
- keeping study equipment (notes, pens, etc.) in order
- listening in class
- following directions
- taking part in class discussions
- getting assignments in on time
- asking questions when unsure
- reviewing notes after a class
- preparing for tests days in advance
- review previously taught lessons
- trying your best at all times

Students can concentrate on specific groups of skills related to:

Classroom

- listening carefully
- reading ahead in the text
- noting important/key points
- asking for clarification
- bringing required materials to class
- trying to relate what has been taught to personal experiences and other subjects

Studying and Homework

- finding a quiet area to study/work
- having all the materials needed to study such as text, notes, handouts, etc.
- working from a schedule/timetable
- studying at regular times
- following a set format each time

Reading and Studying a Textbook

- skim through headings to get an overview
- break the chapter into sections and read each one carefully
- look for linkages/connections
- ask yourself questions based upon what you have read
- summarize the key points
- look up words that you don't understand
- make use of special sections like the table of contents/glossary

Taking Notes

Good notes apply to all grade levels. Notes provide you with a record of what has been covered. They assist in completing classroom assignments, projects, and essays. Notes are a major study aid for tests.

1. Organize notes around key points
2. Keep all handouts
3. Number pages to keep them in order
4. Use major headings and subheadings to organize notes
5. Tidy up your notes the same day you take them rather than trying to do so two weeks later
6. Review your notes often to make sure that they are complete and make sense

Making A Study Schedule

A study schedule is a calendar, chart or grid which sets out certain tasks which the student is to complete at specific times on specific dates.

1. Use a realistic amount of time nightly
2. Proportion your time for:
daily class assignments
projects, essays, etc
review for tests
3. Be sure to allow time for each subject
4. Keep track of due dates for all class assignments, projects, essays, test
5. Be sure to clarify details of all assignments before you leave school

RECORD OF DAILY ASSIGNMENTS

PERIOD	SUBJECT	ASSIGNMENT	DUE DATE
1			
2			
3			
4			
5			
6			
7			
8			

ORGANIZE A HOMEWORK/STUDY SCHEDULE

TIME	MON	TUES	WED	THURS	FRI	SAT	SUN
7-8 am							
8-9 am							
9-10 am							
10-11 am							
11-12 am							
12-1 pm							
1-2 pm							
2-3 pm							
3-4 pm							
4-5 pm							
5-6 pm							
6-7 pm							
7-8 pm							
8-9 pm							
9-10 pm							
10-11 pm							

LOOKING AT PROBLEMS AND QUESTIONS FROM DIFFERENT PERSPECTIVES

People often say that "science is good questions." In science there are many different types of questions and problems. Depending on how a question is worded, it may refer to a different curriculum emphasis.

A good way to focus questions/problems according to curriculum emphases is to look at three basic forms of questions

WHY? HOW? SHOULD?

"WHY?" questions normally have to do with the nature of science.

*Why does bread go moldy?
Why do engines require oil?*

"HOW?" questions normally focus on science and technology. In many cases, a problem solving model has been used since the way we often solve problems is to invent a technology.

*How can we prevent bread from molding?
How can motor oil be produced?*

"SHOULD?" questions often deal with the relationship between science, technology and societal decision making.

*Should preservatives be added to bread?
Should motor oil be recycled?*

DEALING WITH DIFFERENT TYPES OF PROBLEMS

SAMPLE PROBLEMS	SCIENCE	TECHNOLOGY	SOCIETY
	<i>Why does my hot chocolate cool so quickly?</i>	<i>How can I make a container to keep it hot?</i>	<i>Should we use styrofoam cups or coffee mugs?</i>
	<i>Why does my pop go flat when it sits?</i>	<i>How could I prevent this?</i>	<i>Should soft drink companies be allowed to sell pop in non-returnable containers?</i>
	WHY?	HOW?	SHOULD?
PROBLEM SOLVING STRATEGY	scientific inquiry	technological problem solving	deliberation consensus building decision making

A MATTER OF PERSPECTIVE

Whenever students discuss issues they should be able to see different points of view presented from a perspective other than the one with which they agree. The teacher's role is to point out to students that there are other points of view and students should be encouraged to explore other perspectives and to debate the issues.

A brief synopsis of the perspectives which should be explored include:

Scientific Perspective

reporting on what is currently known about the topic; what research is going on; what questions remain unanswered.

Technological Perspective

deals with products or processes that satisfy needs and wants; involves the discussion of solutions to practical problems.

Aesthetic Perspective

deals with artistic impact to the viewer, elements of "beauty", etc.

Societal Perspectives

Political Perspective

government policy or initiatives; quoting of government officials, agencies

Economic Perspective

how much will it cost; costs related to research and development, cost of constructing it, costs associated with possible environmental clean-up; economic effect of a technology on certain workers.

Environmental / Ecological Perspective

examination of the effects of any factor on the environment.

Legal Perspective

involves the law; what is the position in law; are any changes being proposed?

Ethical Perspective

involves the discussion of what is morally right or wrong with regard to a particular issue, e.g., genetic engineering

Emotional Perspective

involves how you feel about something, how it personally affects you "inside"

PERSPECTIVES ON ISSUES

Scientific
Technological
Asthetic
Political
Economic
Environmental/Ecological
Legal
Ethical
Emotional

SUSTAINABLE DEVELOPMENT INFORMATION FOR JUNIOR HIGH TEACHERS

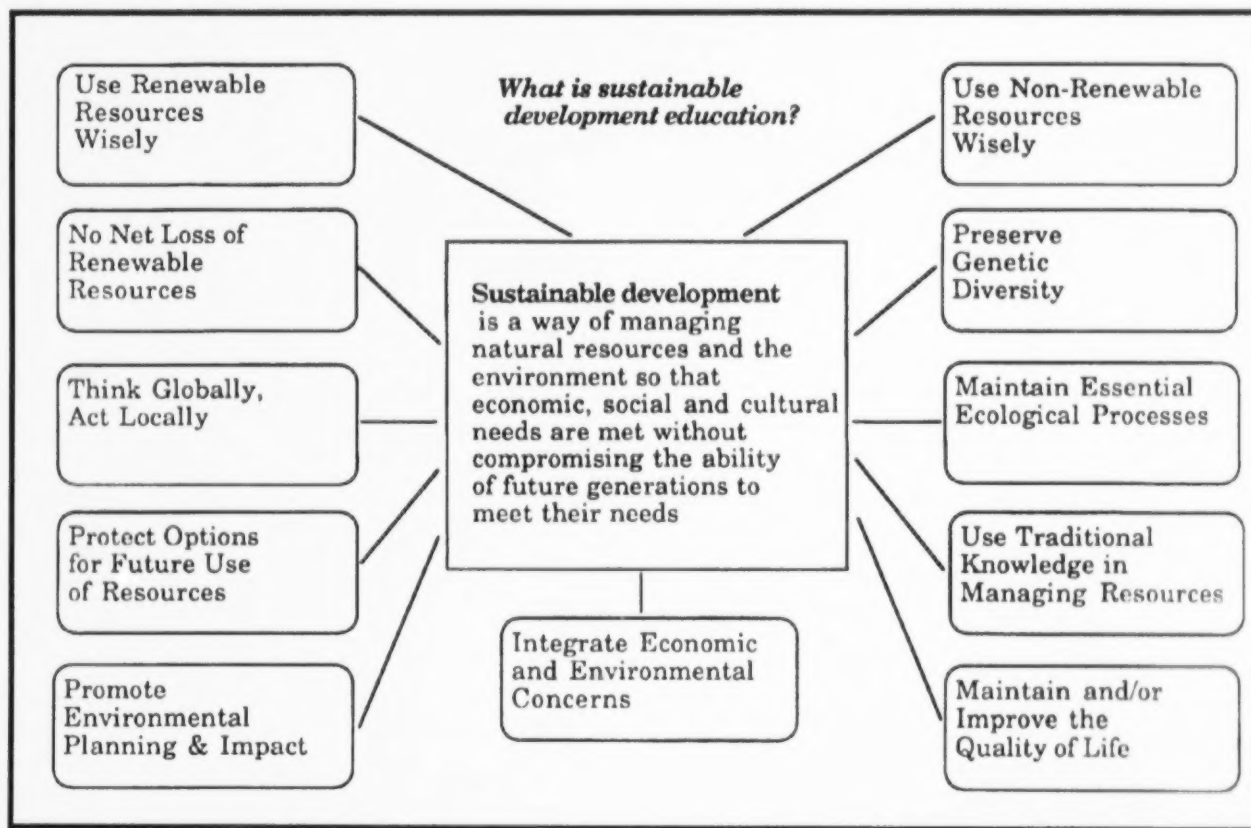
Over the past few years the topic of sustainable development has gained international prominence not only in educational and environmental circles but also in the realm of economics and politics.

In April 1987, the United Nations Brundtland Commission on Environment and Development produced a report called, "Our Common Future", which drew global attention to the destruction of the World's resource base. The report's main premise was that we cannot continue to develop anywhere unless we protect the environment at the same time.

In September of 1987, the Canadian

Council of Resource and Environmental Ministers published a "Report of the National Task Force on the Environment and the Economy". The task force recommended that industry, government and environmental organizations join forces to implement **sustainable development**.

In November of 1988, the Science Council of Canada published its report called, "Environmental Peacekeepers: Science, Technology, and **Sustainable Development** in Canada". They stated that environmental deterioration is in large part due to unsustainable development in advanced countries and in the Third World.



It is in Canada's long term interest to clean up its own backyard while addressing global issues through International organizations. Education certainly has a major role to play in maintaining what has become "Our Common Future".

The Special Committee on the Northern Economy (June 1989) described in very clear terms the path to **sustainable development**. "Whatever we do to improve our economy, we must ensure that we protect and promote our basic values. Though these basic values may be expressed in different cultural terms, they all seem to come down to the same realities: economic independence, protection of the land and the environment, a sense of self and identity and control over our lives, meaningful work, the ability to live meaningful lifestyles, a sense of community and personal worth".

WHAT CAN TEACHERS DO?

Teachers can continue to teach about environmental issues as they relate more specifically to where they live and to Canada in general. Being an effective teacher means staying current with important issues relevant to our student's future and the kind of world they will inherit. Start local and move towards the national and international scene.

Sustainable development education simply links environmental issues more closely to the economic and industrial aspects of our environment and economy.

WHERE DOES SUSTAINABLE DEVELOPMENT FIT INTO THE CURRICULUM?

Grade 7 to 9 General Topics

- Interdependence of Living Things
- Animal and Plant Populations
- Northern Environmental Problems
- Energy Systems
- Heredity & Genetics

RESOURCES FOR TEACHERS

A Developing World - Elementary Kit of activity sheets and teaching ideas available from C.I.D.A., 200 promenade du Portage, Hull, PQ. K1A 0G4 (free)
A secondary level kit is also available.

"Under the Sun" Sustainable Development magazine for students available from C.I.D.A.

Northern Environmental Problems - Book II - 36 lessons on environmental related issues available free from regional/board resource centres

Sustainable Development newsletter available from Canada Wildlife Service, Envir. Canada, Ottawa, Ontario K1B 0H3

Litterkit - activities, video available from local Renewable resources officer/office

National Wildlife Week Materials and Habitat 2000 program materials - activities, teaching ideas, posters sent to schools yearly by Canadian Wildlife Federation, 1673 Carling Avenue, Ottawa, Ontario K2A 3Z1 (1-613-725-2286)

Arctic Wildlife Sketches - information sheets available from regional/board resource centres

The Question of Food World Food Day filmstrip and teaching materials available from World Food Day Association, 176 Gloucester St., Suite 400, Ottawa, Ontario K2P 0A6 (1-613-233-9002) cost \$20.00

National Geographic Dec. 1988 Issue
"Can Man Save This Fragile Earth?"

Guideposts For A Sustainable Future - video and Planning For Seven Generations (text of ideas, images and information on the relationship between people and the Earth). Order from Guideposts, Box 374, Merrickville, Ontario, K0G 1N0
Cost \$50.00

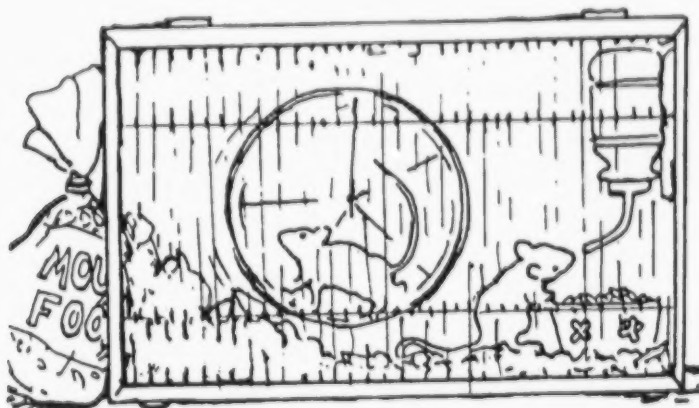
PLANT AND ANIMAL CARE

The presence of plants and animals in the classroom for study and handling can be a valuable asset to any science program. However, certain precautions must be observed to ensure the health and safety of both the students and the study organism.

1. Determine if any of the students have allergies by checking student records or by sending a note home advising the parents of the animals to be kept. In an extreme case, the keeping of animals may have to be ruled out whereas a mild allergy may require that the student simply not handle the animal.
2. Animals should be well fed and cared for. The enclosure in which the organism lives should be of suitable size, easily maintained, and cleaned on a regular basis.
3. All animals which are purchased should be from a reputable supplier. Wherever possible, animals which have been donated should be examined by the veterinarian.
4. Any animal that appears in poor health should be removed from human contact until the situation has remedied itself or until the animal has

been examined. The danger is that the animal may have an infectious ailment.

5. Animals which repeatedly bite should not be kept in the classroom. However, quite often the underlying reason for the animal's behavior is that students have not been advised regarding safe handling of animals. Most animals will bite if just awakened, handled roughly, or when food is taken away. Caution students that too much handling may be stressful for the animal. As a normal procedure, a student who has been bitten should receive a tetanus shot if he/she has not recently had one.
6. Hands should be washed after handling all animals.
7. An animal should be kept in the classroom only so long as it is a meaningful part of the program. A negative learning experience can be created when an animal is left neglected. As well, a potential health hazard could occur.



Suitable Classroom Study Animals

Mammals rabbit guinea pig hamster gerbil mouse	Birds chicks canaries pigeons doves	Insects aphids beetles caterpillars fruit flies ants	Fish goldfish guppies tropical fish
Worms earthworms	Reptiles chameleons small snakes	Crustaceans crayfish	Amphibians frogs tadpoles newts

Animals That Should Not Be kept

No native species of wildlife (wild animals and birds) should be kept in the classroom. To do so can create an unwarranted source of possible infection. In most cases, the keeping of these mammals and birds is also unlawful. Check with your local wildlife officer for more information.

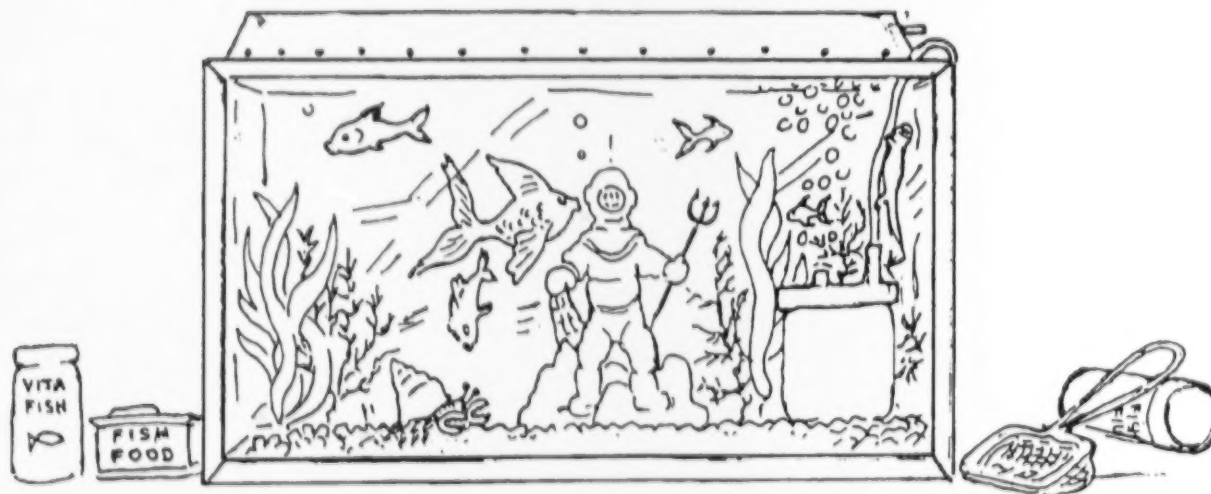
Suggestions For Material

A Woodland Terrarium

Materials - an aquarium or tank or wide mouthed four litre jar set on its side in sand, clay or plaster to keep it from rolling. Gravel on the bottom. Several centimeters of good soil with pieces of charcoal buried in it to keep it from going sour. Rocks, small woodland plants, mosses, and ferns. Water daily, but not heavily.

A Tundra Terrarium

Materials - an aquarium, tank or wide mouth jar set on its side in sand for stability. Make sure that the lid has holes in it to allow for ventilation. To the container add a mixture of gravel and charcoal, for drainage and control of odour, to a depth of 2 to 3 centimetres. Place mosses and other plants on top of the gravel/charcoal mixture. Water frequently so that the mosses do not dry out. Rocks covered with lichen can also be added.



A Desert Terrarium

Materials - the same container as above, but with 5 cm of sand. Cacti from the florist, or grown from seed.

An Ant Farm

An ant farm can be purchased commercially. Another method is to fill a four litre jar with loose soil dug from an ant hill. Tie gauze or a piece of stocking over the top. Feed apple, sugar, peanuts or lettuce in very small pieces. Wrap in dark paper and set aside for a week or two to look at later.

A Mealworm Culture

Put a thin layer of oatmeal or other cereal in a large shallow cake pan. Add mealworms purchased from a pet store or other supplier.

Alternate layers of worms and layers of cereal. Put thin apple slices across the top of the food, and add moisture. Cover with plastic wrap and put in a warm dark place. Check often to see what is happening and keep it slightly damp. If you have reptiles or amphibians for pets, a mealworm farm is necessary to raise food for them.

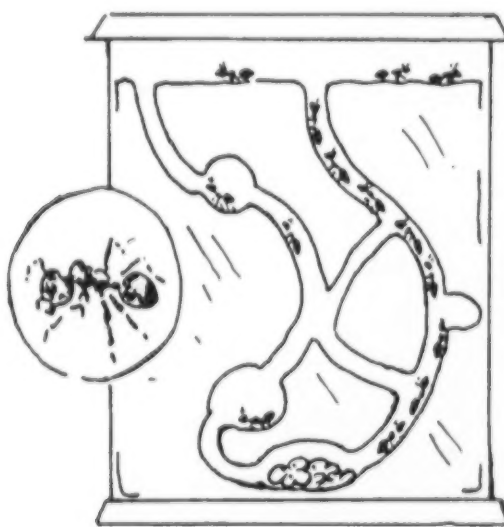
Guppies

Guppies are interesting as the male is easily distinguished from the female and they reproduce often. They require a small aquarium or large bowl filled with washed sand and tap water which has had the chlorine removed by a liquid or tablet developed for that purpose. Water plants are needed for food and oxygen and fish will thrive if an inexpensive aerator or "bubbler" is added. Commercial fish food may be used.

Tadpoles

Collect frogs or toad eggs and carry them home in a container of pond water.

Put into an aquarium with 2 cm of sand and fill with pond water or boiled and then cooled tap water. Add water plants. Feed the tadpoles lettuce or raw liver bits. Aquatic insects may live in the same environment with the addition of sticks slanting up to the sides of the jar above water level. (keep the lid on).





Birds

Keeping a live bird in the classroom provides a good opportunity for the students to learn how to care for it and learn much about its physical characteristics and behaviour. If it is difficult to keep a bird for even a short time, children should observe and feed birds outside, but not to the point where the bird places dependence on human feeding.

Mammals

Most mammals need a cage or pen, straw, shredded paper or sawdust and a diet of grains and greens. The smaller mammals need a drip type bottle and holder. This will ensure the cage remains clean and dry.

Plants In The Classroom

Again, some students may have allergies and you will have to do some investigating in order to identify potential problems. Some leaves of plants such as the Dieffenbachia are poisonous and teachers should eliminate them from the classroom.

Growing plants is a varied and interesting task which students enjoy. Plants can be propagated from roots, stems leaves, bulbs and seeds.

From Roots - Sweet potato, beet, carrot, turnip and parsnip. Put a sweet potato in a jar of water (a large instant coffee jar is good) so that the narrow end sits in water. If the fit is not perfect, anchor the potato with toothpicks for support. Put in a warm dry place, adding water as needed.

When the plant takes root, move it to a sunny place. Carrots, beets, parsnips and turnips grow best on stones, marbles or aquarium gravel in a saucer of water.

From Stems - Pussy willow, geranium, ivy and philodendrons. Many plants will root when placed in water. An ordinary potato and onion are actually stems. A piece of potato with two or three eyes may be planted in soil in a pot. An onion may be set in a glass with a little water in the bottom.

From Leaves - African violets and snake plants. These plants will grow from leaves. Prepare leaves from the snake plant by cutting the leaf into little finger lengths and planting in damp sand, covering with glass. This is the rooting box.

From Bulbs - Anemone, narcissus, hyacinth, tulip and venus flytrap. Bulbs are usually accompanied by planting instructions. As a rule they are planted in a pot which has a few stones or broken pottery in the bottom for drainage,

followed by rich potting soil and a layer of sphagnum moss. They may be well watered, sealed into a plastic bag and refrigerated for six to eight weeks, following which they are brought out to bloom. The venus flytrap obtained as a bulb or plant from florists is interesting to most children as it is carnivorous. The mouth may be opened gently and the plant may be fed live flies or tiny pieces of meat.

From Seeds - Beans, corn, peas, peanuts, citrus fruits, pumpkin, watermelon, canary seed and avocado. To plant an avocado pit, remove the brown papery coat from the seed and set in a jar of water as you did the sweet potato. Put in the dark and be very patient, for it will take weeks to get started. After about two months, add soil gradually or replant it in a larger pot. Plant grain and grasses in a large shallow tray or in a sponge. Line a glass container with blotter or paper towel and plant seeds between the glass and the towel.



Use of S.I.

The metric system (Système Internationale or S.I.) is to be used in N.W.T. schools. The following chart indicates the extent of metric usage in the texts which have been piloted.

TEXT	METRIC	OTHER
English		
Science Directions (Wiley/Arnold)	*	n/a
Science Plus Technology & Society (HBJ/Holt)	*	n/a
Making Connections (Gage)	*	n/a
Living and Working in the Space Age (Fitzhenry & Whiteside)	*	n/a
French		
Les Sciences Apprivoisées (Wiley/Arnold)	*	n/a
SCIENCEPLUS (HBJ/Holt)	*	n/a



PUBLISHERS / DISTRIBUTORS

The following Publishers and their distributors are listed to assist teachers in the ordering of resource materials. The list deals with those directly related with the Junior High Science Program.

Addison-Wesley	Addison-Wesley P.O Box 580 Don Mills, Ontario M3C 2T8	Heath	D.C. Heath Canada Ltd. 100 Adelaide St. West Suite 1600 Toronto, Ontario M5H 1S9
Arnold Publishing	Arnold Publishing Co. 14712-88 Avenue Edmonton, Alberta T5R 4J8	HBJ/Holt	Holt, Reinhart and Winston and Harcourt Brace Jovanovich, Canada Ltd. 55 Horner Ave.
Enviro-Concerns	Enviro-Concerns Box 131 St. James Postal Stn. Winnipeg, Manitoba R3J OH4	Liem, Dr. Tik	Dr. Tik Liem "Invitations to Science Inquiry" c/o Science Inquiry Enterprises 505-12 West Madison Ave., El Cajon, California, USA 92020 1-619-441-8987
Fitzhenry & Whiteside	Fitzhenry & Whiteside 195 Allstate Parkway Markham, Ontario L3R 4T8		
Gage	Gage Publishing Co. 164 Commander Blvd. Agincourt, Ontario M1S 3C7	L.R.D.C.	Learning Resource Distribution Center 12360-142 Street Edmonton, Alberta T5L 4X9
Ginn	Ginn and Company 3771 Victoria Park Ave. Scarborough, Ontario M1W 2P9	J. Weston Walch	J. Weston Walch P.O. Box 158 St. Stephen, N.B. E3I 2X1
GLC/MacDonald/ Silver Burdett	GLC Publishers Ltd 115 Nugget Avenue Agincourt, Ontario M1S 3B1	Wiley	see Arnold Publishing Company

SUPPLIERS

There are many companies to choose from. A few are listed below:

Boreal	Boreal 1820 Mattawa Ave. Mississauga, Ontario L4X 1K6
Fisher	Fisher Scientific Co. 10720-178th Street Edmonton, Alberta T5S 1J3
Northwest	Northwest Laboratories 61 Malcolm Road P.O. Box 1356 Guelph, Ontario N1H 6N8 or 3581 Shelbourne Street P.O. Box 6100, Station C Victoria, B.C.
Sargent-Welch	Sargent-Welch Scientific of Canada 4220-23rd St. N.E. Bay No. 12 Calgary, Alberta T2E 6X7
Scholar's Choice	Scholar's Choice 777 Douro Street Stratford, Ontario N5A 6T9
Spectrum	Spectrum Educational Supplies Ltd. 8 Denison Street Markham, Ontario. L3R 2P2